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Windmöller & Hölscher KG
Münsterstraße 50
49525 Lengerich/Westfalen

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Perforated Form-Fill-Seal (FFS) Bag

The invention relates to a gusseted bag according to the preamble of claim 1, a method for the production and filling of such a gusseted bag and a corresponding form-fill-seal (FFS) machine.

The generic filling of bags is carried out using the most different devices. The bag to be filled is often grasped by a plurality of pairs of gripping pliers during the filling process.

The so-called FFS machines form a sub-group within the category of filling machines. Here, the abbreviation FFS stands for **F**orm, **F**ill and **S**eal, as a result of which a special characteristic of the operation mode of these machines lies in the welding of the bags after the filling process.

Such a device is known *inter alia* from the German patent specification DE 199 36 660 A1. There a tube section provided with a bottom weld seam and made of thermoplastic is filled with fillers in a filling station.

These machines are superbly suitable for the rapid and cost-effective formation and filling of bags.

The bags produced by FFS machines are often filled with free-flowing goods. Also due to this reason, these bags are usually not provided with any holes or incisions. A first exception is formed by breather holes, which are usually inserted into a large part of the outer surface of the bag. These openings are often designed such that their diameter amounts to not more than one mm in order to prevent the fillers from trickling out. Meanwhile, so-called microperforations have been developed for particularly fine fillers, wherein said microperforations comprise breather holes having diameters, which are smaller than 0.2 mm.

In recent times, there has been a necessity of providing these bags with a tear-open perforation. In this context, the term "tear-open perforation" is meant to connote a perforation made from incisions or punchings. These incisions or punchings are usually longer and/or larger than the breather holes described. Thus incisions of a length of 2 to 10 mm have proved to be useful. However, incisions having a length of 4 to 7 mm are preferred. In the wording used in this document, a single cut or a single punching, which serves for tearing open the bag subsequently, is also a perforation. Such a cut must then be inserted into the film material preferably at the edge of the bag and usually has a length, which exceeds the preferred length of the perforation cuts addressed above. A tear-open perforation serves for the simplification of the process of tearing open the bag cover. The process of tearing open the bag covering, as set forth in this document, can also involve tearing off parts of the bag cover, such as parts of the bottom seam or the head seam.

For the production and the filling of the hitherto known bags having tear-open perforations using the FFS process, the film tubes from which the related FFS machine forms the bags, are perforated by a perforation device that is not associated with the FFS machine, before the tubes are wound up again and before this tube roll is supplied to the FFS machine.

However, in the use of these bags it has been seen that the tear-open perforation forms a weak spot through which the filler trickles. So far, this disadvantage has either been put up with or such a perforation of bags has been totally omitted for fillers of a free-flowing nature.

It is therefore the object of the present invention to provide a flat bag or a gusseted bag,

- which is produced and filled by an FFS machine and
- which can be torn open easily and
- which is characterized by lower trickling losses.

The present invention is based on the described gusseted bags produced and filled using the FFS method and attains said object by providing the bag with a corner weld seal in the area of at least one corner.

Owing to the inventive measure, it is not possible for the fillers to trickle through the perforation cuts, which are arranged between the bag edge and the corner weld seal. The inventive measure is similarly suitable for flat bags—as specified in claim 1.

Additional example embodiments of the invention are based on the present description and the claims.

The individual figures illustrate:

- Fig. 1 an inventive bag
- Fig. 2 a bag according to the prior art
- Fig. 3 another embodiment of the inventive bags
- Fig. 4 another embodiment of the inventive bags
- Fig. 5 another embodiment of the inventive bags
- Fig. 6 another embodiment of the inventive bags
- Fig. 7 a web-cutting, welding and perforation station in the passive state
- Fig. 8 the same web-cutting, welding and perforation station as in figure 7,
 during the cutting, welding and perforating steps
- Fig. 9 an illustration of a film tube section
- Fig. 10 a sketch of an incision tool

Figure 2 illustrates a gusseted bag 201 according to the prior art, in which the side-gussets are indicated by the dashed lines 203. As is common in case of an FFS bag, a bottom seam 205 seals the end of the bag at the bottom end 210 and a head seam 204 seals the end of the bag at the top end 211. The bag comprises a tear-open perforation having perforation incisions 207.

In contrast, figure 1 illustrates an already very advanced example of an inventive bag 200, which is provided with corner weld seals 206. Furthermore, it can be observed that the tear-off perforation breaks down into a tear-off perforation having longer perforation incisions 207 and a tear-off perforation having shorter perforation incisions 208. The longer perforation incisions 207 are located in the area between the edge of the bag 209 and the corner weld seal 206, while the shorter incisions 208 are located in the area between the centerline M of the bag 200 and the corner weld seal 206 of the corner, which is impinged with the tear-off perforation. It can be further observed that the bag 200 stands on its head as opposed to the bag 201. That is, the bottom end of the bag 210 is located in the upper area of figure 1, while the top end is located in the lower area. The tear-off perforation 207, 208 is thus located in the area of the bottom end of this bag, which proves to be advantageous in the filling process, which is still to be described.

Figure 3 once again illustrates the bottom section 210 of the bag 200, which is already illustrated in figure 1 and whose characteristics are already described above.

Figure 4 illustrates another embodiment 212 of an inventive bag comprising the inventive corner weld seals 206. Unlike the already illustrated embodiment 200, the bag 212 has only one notch or one incision 213. As mentioned already, this single incision is also considered as a tear-off perforation as set forth in the present document.

Passages (labyrinth ventilation) 229 can be inserted in an inventive corner weld seal for better ventilation of the bag. It is expedient, if these passages 229 also do not let any filling material pass. The tear-off perforation of the bag 214 illustrated in figure 5 is designed differently. It is composed of a tear-off perforation 207 having long incisions and a perforation 208 having shorter incisions, just as the tear-off perforation of the bag 200. However, this tear-off perforation is further provided with a perforation 215, which

permits a part of the weld seam 208 to be torn open, which seals bottom end 210 of the bag 214. This facilitates the process of tearing off this part.

Figure 6 illustrates a last embodiment of an inventive bag 217. Similar to the embodiment with the bag 200, a perforation having long perforation incisions 207 is present in the area between the edge 209 of the bag 217 and the corner weld seal 206. However, this applies to both the corners of the bottom area 210 of the bag illustrated, said bottom area being illustrated in figure 6. Another perforation 216, which is formed by shorter perforation incisions is located between the two corner weld seals 206 of the bag 217.

Components of an FFS machine are illustrated in figures 7 and 8. The position of these components can be seen *inter alia* in the figures of the German patent application 102 17 397.4, which is not yet published. The machine components illustrated are a web-cutting and welding station 230 and also a needling station 240. However, the components normally provided for the needling and ventilation of the bag are used for perforation. The web-cutting and welding station 230 is usually located in an FFS machine in the front area of the processing cycle. The film tube 219 is usually unwound by an unwinder and is supplied using draw rollers 218 into the web-cutting and welding station. Figures 7 and 8 illustrate the web-cutting and welding station 230 starting with the pair of draw rollers, which is formed of the draw rollers 218. The film tube 219 runs through the roller clearance formed by these two draw rollers 218 and into the web-cutting, welding and perforation station 230. The perforation station 220 consists, in detail, of the holder of the knife support 221, to which the knife support 223, moveable in the x-direction, is linked. The knife support 223 supports the knife 228 and also the rubber squeeze 224. Should the knife support 223 move in the x-direction, the knife 228 travels through the scraper 226 or through a recess (not illustrated) of the scraper 226 and into the knife receiving channel 227, of the backing run of the knife 225. The backing run of the knife 225 is formed by a cross bar. In the transport direction z of the film tube, the first perforation station 220 is followed by the web-cutting station 230, which in turn consists of the holder of the knife support 231, the knife support 233, the knife 226 [sic], the sealing jaw 234, the backing run 235, the knife receiving channel 236 and the knife 238. The incision

movement of the knife 238 takes place similarly to the incision movement in the first perforation station 220, which can also be seen on the basis of figure 8. Figure 8 illustrates the first perforation station 220, the web-cutting and welding station 230 and the second possible needling station 240 in the state in which they cut into the web of blown film and cut through or perforate the web of blown film. The second needling station 240 already mentioned above is designed similarly to the first perforation station 220. The functional elements 241-248 of the second needling station 240 are numbered similarly to the functional elements 221-228 of the first perforation station 220. Either of the two perforation stations can be used for needling while the respective other station is used for perforation.

Figure 9 illustrates the section 250 of a film tube, into which the center cut 256 is inserted, thus dividing the film tube into two bags. It can be seen above the center cut 256 that the subsequently resulting bag is of the same type as the bag 200 illustrated in figures 1 and 3. The bottom end 210 of this bag can be seen above the center cut 256. The bag is provided above the bottom end with a cross-weld seam 258, which forms the bottom. Large perforation incisions 207 and shorter perforation incisions 208 are located in the area of one of the corners of the bag. In addition to the already illustrated features of the bag 200, figure 9 illustrates needlings 251, which specify, by way of example, that the bag can also be needled. Figure 9 also illustrates inventive corner weld seals 206. However, it must be observed that the illustrated bag section need not be strictly present in this form during the production of the bag. Rather, it is possible, for example, that the corner weld seals 206 and the bottom seams 205 are added to the bag 200 even before its separation from the film tube 219. Therefore, the purpose of figure 9 in the first place is to illustrate the location of the various features of the bag 200.

Figure 10 illustrates a perforation tool 259, which consists of the perforation knives 253 and 252, which are attached to the knife support 254. These perforation knives cut into the tube section 250. A four-layer film material 257 and a two-layer film material 260 are present in this section of a film tube 250, said section also being illustrated in figure 9. The four-layer film material 257 is present in the area of the side-gussets while the two-

layer film material 260 exists in the middle area of the bag. The arrows z and y in figures 9 and 10 illustrate the respective position of the bag components. Here, as in case of the other figures, z corresponds to the transport direction of the film tube, while y runs in the direction of the width of the film tube and/or of the bags. The two figures 9 and 10 are aligned in the y direction wherein the right part of the film tube section 250 is not illustrated in figure 10. In addition, figure 10 illustrates that the knives 253 cut further into the tube section 250 than the knives 252, thus bringing about the variable length of the perforation incisions 207 vis-à-vis the perforation incisions 208. The knives 253 and 252 are usually clamped on the knife support 254.

List Of Reference Numerals	
200	Bag
201	Gusseted bag
202	
203	Edge of the side gussets, dashed line
204	Head seam
205	Bottom seam
206	Corner weld seal
207	Tear-open perforation with longer perforation incisions
208	Tear-open perforation
209	Bag edge
210	Bottom end of the bag
211	Top end
212	Inventive bag
213	Incision
214	Inventive bag
215	Perforation
216	Perforation
217	Inventive bag
218	Draw roller
219	Film tube
220	Perforation station
221	Holder of the knife support
223	Knife support
224	Rubber squeeze
225	Backing run of the knife
226	Scraper
227	Knife receiving channel
228	Knife

229	Passage
230	Web-cutting and welding station
231	Holder of the knife support
232	
233	Blade holder
234	Sealing jaw
235	Backing run
236	Knife receiving channel
237	
238	Severing knife
239	
240	Needle station
241-248	Functional elements
249	
250	Section of a film tube
251	Needling
252	Perforation knife
253	Perforation knife
254	Knife support
255	Gusset edge
256	Center cut
257	Four-layer film material
258	Cross-weld seam
259	Perforation tool
260	Two-layer film material
x	Direction of movement of the knife support 223
y	Direction perpendicular to the directions x and z
z	Transport direction of the film tube